Name: _____ Date: _____ Period: _____

Must-Knows: Unit 4 (Biochemistry)
Ms. OK, AP Biology, 2014-2015

Test Format: 21 multiple choice questions, 1 short response question

Topic #1: Atoms and Molecules

1. What type of bond forms between calcium (Ca) and chlorine (Cl)? Note: Ca has an electronegativity value of 1.0, and chlorine has an electronegativity of 3.0 . The table below lists the potential electronegativity differences between atoms and their corresponding bond types.

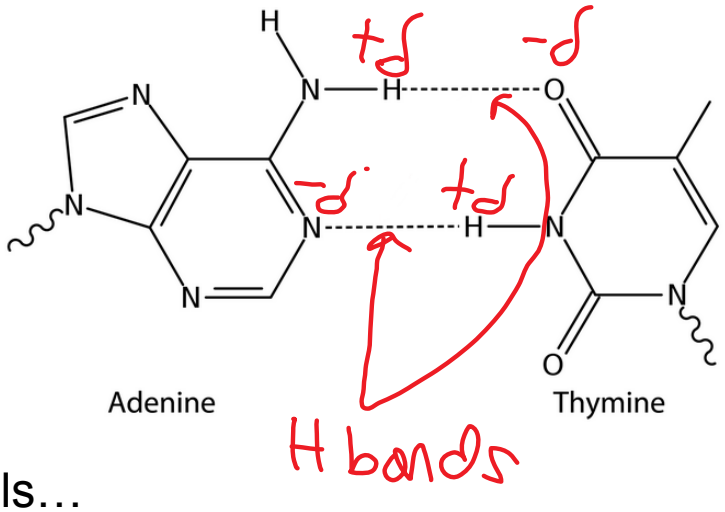
Electronegativity Difference	Bond
Greater than or equal to 1.8	Ionic
0.5-1.7	Polar Covalent
Less than or equal to 0.4	Nonpolar Covalent

Ionic bond, electronegativity difference between atoms is 2.0 (3.0 – 1.0)

2. What is electronegativity? How can we use the electronegativity values of two atoms to figure out which will become a positively charged ion and which will become a negatively charged ion within an ionic bond?

Electronegativity = tendency of an atom to attract electrons to itself
The more electronegative atoms will become a negative ion and the less electronegative atom will become a positive ion.

3. Label the hydrogen bonds shown between adenine and thymine in the image to the right. Write in the partial charges next to the atoms that participate in the bonds. Note: Partial charges are denoted by the following symbols…



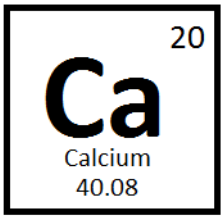
$\delta+$ or $\delta-$

H bonds always occur between the H on one molecule and N,O,F on another molecule. They are usually indicated with a dotted line. H is less electronegative than N,O, or F, so it ends up with a slight positive charge.

4. List the following four types of bonds in order from weakest to strongest: nonpolar covalent, ionic, hydrogen, and polar covalent.

Hydrogen, nonpolar covalent, polar covalent, ionic

5. For the element shown to the right (calcium), list the number of each subatomic particle—protons, neutrons, and electrons—in a neutral atom of this element. Also, identify the atomic mass and atomic number of calcium.



Protons = 20 (atomic number), Neutrons = 20 (atomic mass – atomic #), Electrons = 20 (to have a neutral atom, have to have the same # of protons and electrons)

Atomic Mass = 40.08

6. Calcium forms an ion with a charge of +2. How many electrons are found in the ionized form of calcium? Explain your answer.
18, a + charge means you have lost electrons

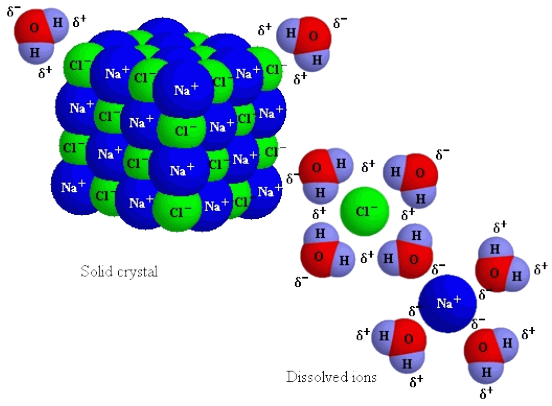
Topic #2: Properties of Water

7. Explain why areas near a lake tend to be cooler in the summertime than areas that have no large body of water nearby. Use the term high specific heat / heat capacity in your answer.
Water has a high specific heat so it requires a lot of energy to raise the temp by one degree.

8. Explain why sweating helps cool humans down. Use the term high heat of vaporization in your answer.

Water has a high heat of vaporization which means it takes a lot of energy to change it from a liquid to a gas…. So when sweat (mostly water) evaporates, it takes heat energy from the body

9. The following image shows salt (NaCl) dissolving in water. Use the image to explain why water's polarity allows it to act as such an excellent solvent (i.e.) a substance that dissolves other substances?
Water's positive and negative charges attract to opposite charges on the solute, isolating the different components of the solute



10. Why do large bodies of water tend to remain at least partially liquid during the wintertime?

Ice is less dense than liquid water, so it floats and insulates the water below it… also, water has a high specific heat / heat capacity, meaning it doesn't change temperature easily

11. The carbonic acid-bicarbonate buffer system maintains blood pH between 7.38 and 7.42. The system involves the use of HCO3- (bicarbonate, a weak base and H+ acceptor) and H2CO3 (carbonic acid, a weak acid and H+ donor) to minimize changes in blood pH.

$$H_2CO_3 \text{ <----> } HCO_3^- + H^+$$

If the pH of the blood increases, one would expect this buffer system to respond by… (In other words, the reaction would shift in which direction? How will the concentrations of carbonic acid and bicarbonate change?)

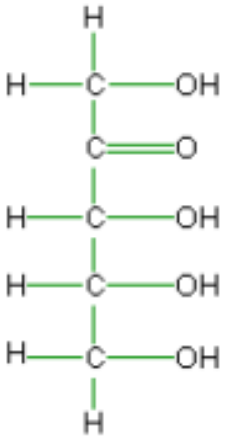
pH of the blood increasing → more basic (less H+)… we want to increase the amount of H+ to bring pH back down (more acidic)

Reaction shifts to the right (more carbonic acid breaks down into bicarbonate and H+)

12. How does hydrogen bonding contribute to the high surface tension of water?

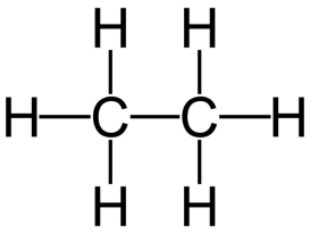
H bonds hold water molecules together (cohesion). Cohesion on the surface of a water, results in a thin film forming (surface tension)

13. Is the molecule pictured to the right polar or nonpolar based on the presence of certain function groups? Explain your answer.



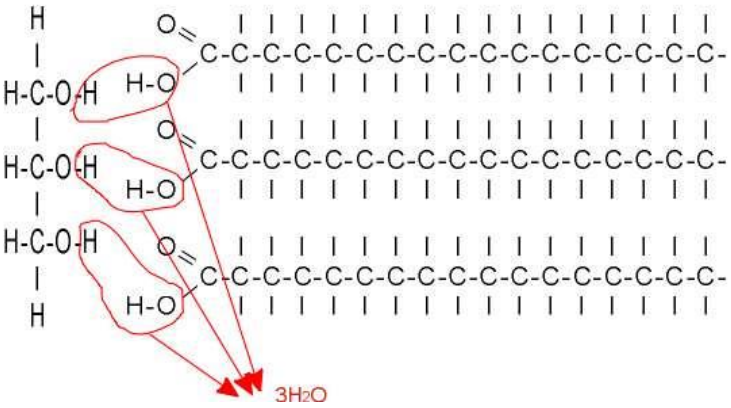
Polar (presence of polar carbonyl and hydroxyl groups)

14. Is the molecule pictured to the right polar or nonpolar based on the presence of certain function groups? Explain your answer.



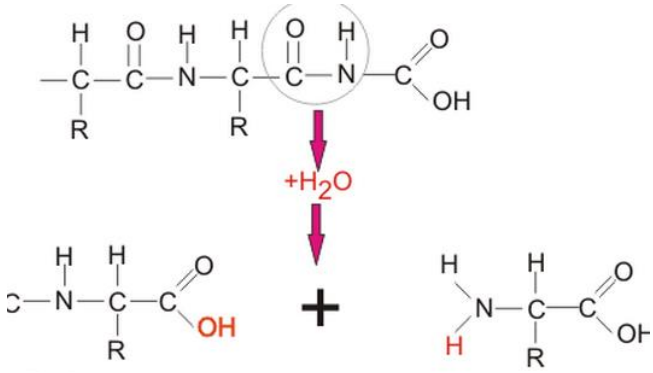
Nonpolar (presence of nonpolar methyl groups)

15. Does the image to the right show dehydration synthesis or hydrolysis? How do you know? What molecule is being created, and from what parts?



Dehydration synthesis, water is lost to build a triglyceride (fat) from three fatty acids and a glycerol.

16. Does the image to the right show dehydration synthesis or hydrolysis? How do you know? What molecule is being broken, and into what parts?

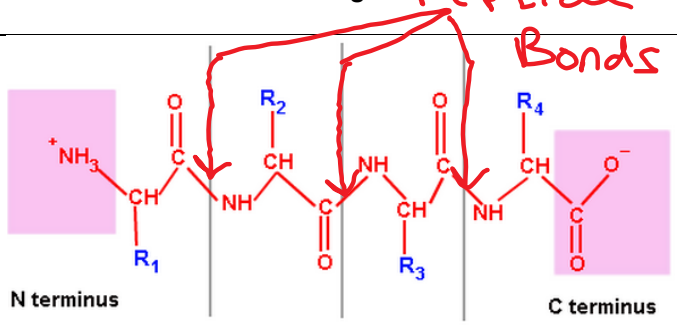
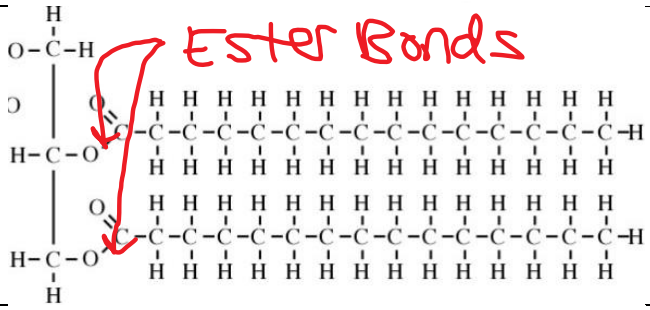
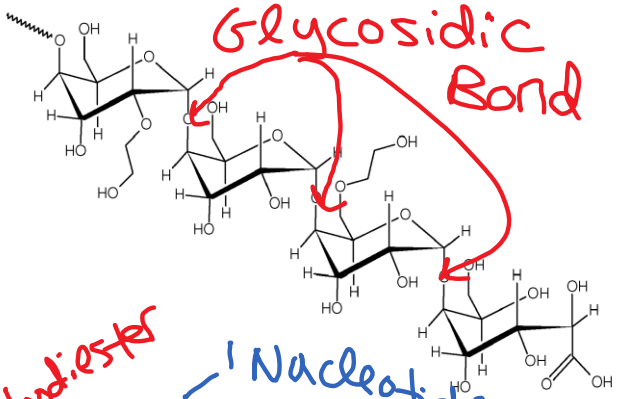
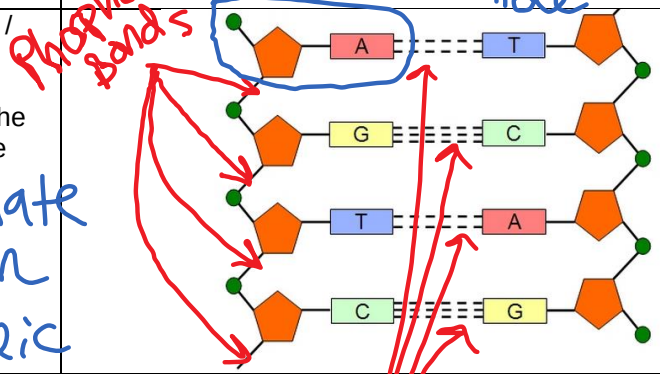


Hydrolysis; water added to break the polypeptide into single amino acids

17. List names and examples of monomers and polymers for each macromolecule in the chart given below.

Macromolecule	Monomers	Polymers
Carbohydrates	Name: Monosaccharides Examples: glucose	Name: polysaccharides Examples: starch
Lipids	Names: fatty acids, glycerol	Examples: triglycerides
Proteins	Name: amino acids	Name: polypeptides
Nucleic Acids	Name: nucleotide	Examples: DNA, RNA

18. Label the types of covalent bonds created by dehydration synthesis and broken by hydrolysis in the images given below. Also, identify the type of macromolecule in which this bond type is found.

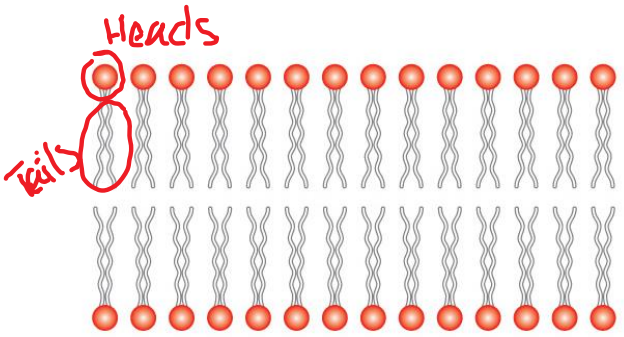
Type of Bond	Image	Type of Macromolecule
Peptide Bond / Linkage ↳ protein		protein
Ester Bond / Linkage ↳ ester ↳ lipid		Lipid
Glycosidic Bond / Linkage ↳ Think glucose		Carb
Phosphodiester Bond / Linkage (Please also identify the hydrogen bonds in the image) ↳ phosphate groups in Nucleic Acids		Nucleic Acid

19. Explain the difference between a saturated and unsaturated fatty acid. Which is better for your health and why?

Saturated fatty acids have all single bonds between carbons; unsaturated fatty acids have one or more double bonds between carbons, resulting in a bent chain → pack less tightly → liquid at room temp → don't clog arteries

20. Explain how the structure of cellulose (a polysaccharide) contributes to its function.
Bonds between glucose monomers are 1,4 beta linkages → point in opposite directions → straight cellulose chain that can H bond with nearby cellulose chains → thick cellulose fiber (good for cell wall structure)

21. Label the hydrophilic heads and hydrophobic tails of the phospholipid bilayer (cell membrane) shown to the right. Why do they arrange themselves this way in the membrane, and why are the tails unsaturated?



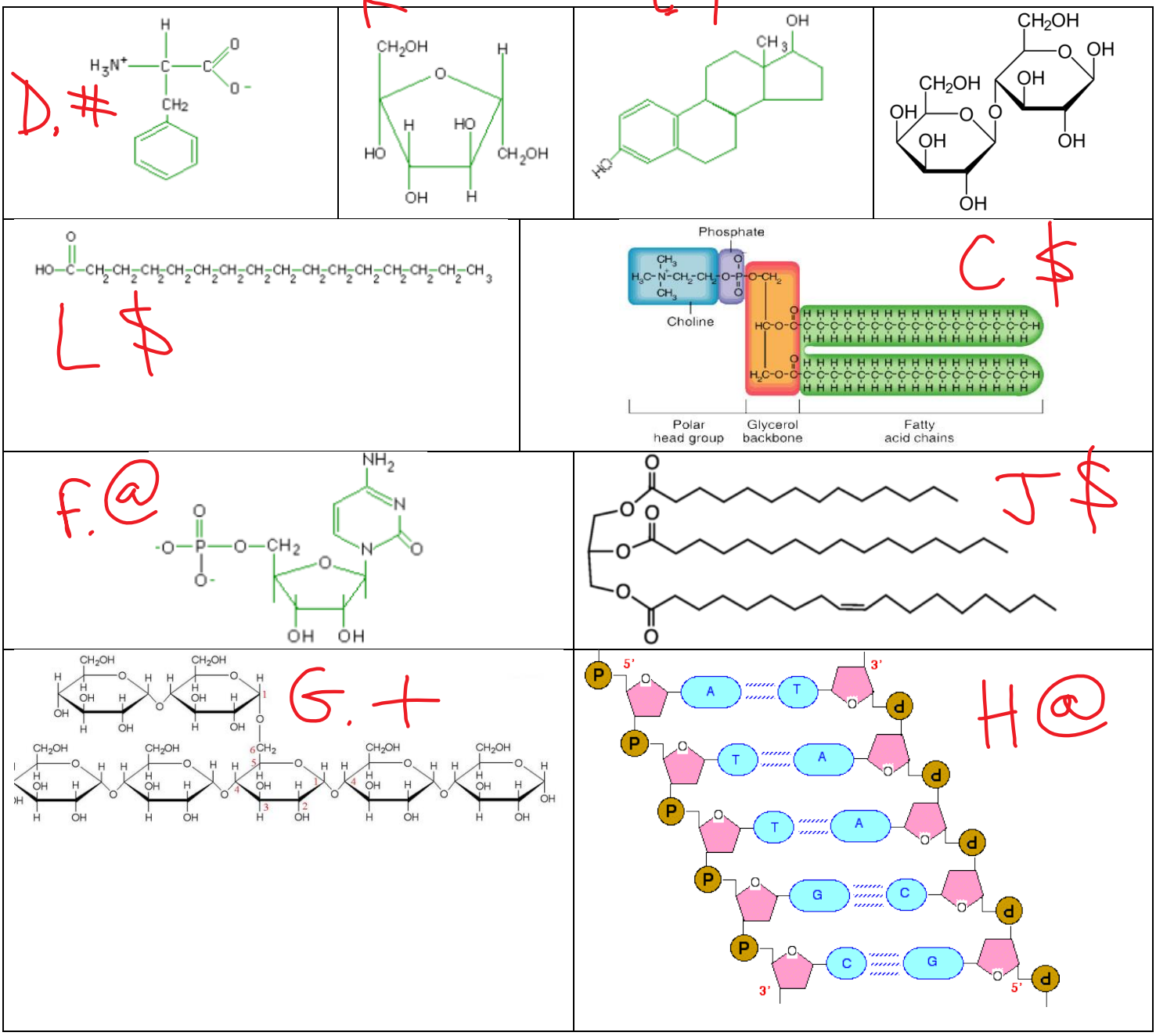
Heads want to be near the water on the outside and inside of the cell, tails don't

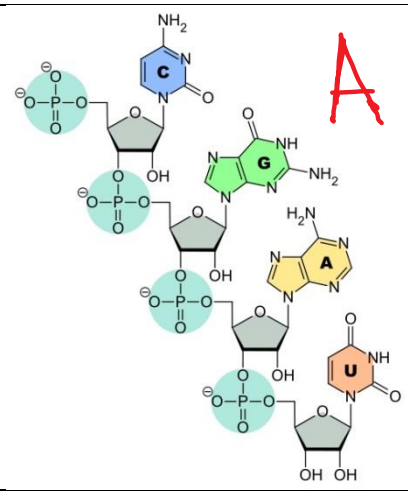
Unsaturated tails → bent, space farther apart → membrane is more flexible

22. Label each of the images below with the letter that corresponds to the correct name of the molecule. Also, identify whether the molecule is an example of a carbohydrate, lipid, protein, or nucleic acid using the following symbols…

A. RNA
B. Disaccharide
C. Phospholipid
D. Amino Acid
E. Steroid
F. Nucleotide
G. Polysaccharide
H. DNA
I. Polypeptide
J. Triglyceride
K. Monosaccharide
L. Fatty Acid

Carbohydrate: +
Lipid: $
Protein: #
Nucleic Acid @



 A @	I #